

Impact of Incidents on Traffic Congestion in Dar es Salaam City

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ABSTRACT

Poorly managed traffic incidents have largely contributed to congestion and delay in the city of Dar es Salaam. A thorough understanding of travel delays caused by incidents is therefore essential for effective countermeasures against the increasing congestion. The method used to determine delays in this research is based on the deterministic queuing theory. Information on incidents was obtained from traffic surveys, traffic police and road users. Counting of the number of vehicles passing the incident location was done on incident and incident-free days. The cumulative traffic counts on incident and incident-free days were then calculated and used to plot the queuing diagram used to determine incident induced delay. This method turned out to be a useful tool for estimating incident induced delay in areas with less sophisticated equipment i.e. where there are no sensors, CCTV cameras, etc. The method provided good estimates of incident induced delay which may help planners and transportation officials in better understanding incident related congestion and in selecting more effective countermeasures against incident related traffic congestion in the city. It was found out that the effects of incidents were different for the different zones, types of incidents and the periods the incident occurred. In addition to the incident duration and the number of vehicles affected, the impact of incidents also depended on availability of alternative routes, number of lanes on the road, discipline of the driver in manoeuvring at incident location and traffic control at the scene.

1. INTRODUCTION

1.1 Background

Traffic congestion can have significant adverse economic, social and environmental impacts within densely populated urban areas. A traffic incident is one of the major factors contributing to traffic congestion. Traffic incident refers to any event that degrades safety and slows traffic, including disabled vehicles, accidents, debris on the roadway and hazardous material spills; it basically temporarily reduces the roadway

capacity. On a nearly saturated road, a small reduction in its capacity can lead to a dramatic increase in traffic congestion. Most major roads in Dar es Salaam city are operating at/or above capacity during peak hours resulting in an increasing potential for traffic incidents and significant delay to the travellers. There is a need to address the incident problem in order to avoid the resulting delays, which also may result in one or more of the following (i) wasting time of motorists and passengers (ii) inability to forecast travel time accurately (iii) wasted fuel, increased air pollution and carbon dioxide emissions owing to increased idling, acceleration and braking (iv) wear and tear on vehicles as a result of idling in traffic and frequent acceleration and braking, leading to more frequent repairs and replacements (v) stressed and frustrated motorists, encouraging road rage and reduced health of motorists (vi) blocked traffic interfering with the passage of emergency vehicles, and (vii) increased vehicle operating costs due to more fuel usage.

The term incident includes vehicle breakdowns, debris on the road, roadside distractions, spilled loads and accidents. With a good understanding of incident-induced congestion, transportation agencies will be able to select more effective countermeasures against roadway traffic congestion. Special attention should be paid to travel delays caused by incident-related congestion which may be cost-effectively alleviated through traffic management, control and incident response. To mitigate Incident Induced Delay (IID), a better understanding of incident impacts on traffic and traffic evolution during an incident is indispensable.

1.2 Objective and Scope of the Study

The main objectives of the study were to measure how much traffic incidents contribute to traffic delays and recommend measures to be taken to reduce traffic congestion caused by traffic incidents.

The study was limited to major roads in the Dar es Salaam city. The study considers the impacts of incidents that are on the road, it does not cover off-road incidents and incidents which last for a very short period say less than 5 minutes.

2. LITERATURE REVIEW

2.1 Methods used to Estimate Incident Induced Delay

Traffic incidents result in substantial travel delays [1]. To minimize the impacts of traffic incidents, researchers have made enormous effort in developing procedures for detecting and estimating Incident Induced Delay (IID). Existing procedures for calculating IID have been based on either the deterministic queuing theory or shock wave analysis.

The queuing theory-based procedures calculate IID by using the queuing diagram formed by the cumulative vehicle arrival and departure curves. The area between these curves represents the total delay in units of vehicle-hours. Queuing theory has also been applied to estimate delays at work zones on freeways [2].

Traffic flow has some characteristics similar to those of fluid flow. Several researchers have therefore attempted to use kinematic wave theory to explain the behaviour of traffic flow. These attempts have led to the development and application of shock wave analysis for estimating IID.

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